http://journal.uir.ac.id/index.php/JGEET
E-ISSN : 2541-5794
P-ISSN : 2503-216X

Journal of Geoscience, Engineering, Environment, and Technology
Vol 04 No 02 2019

RESEARCH ARTICLE

Identification and Stratiraphic Position of Mollusk Type Locality at West Progo Stage

Hita Pandita[1*], Hill Gendoet Hartono[2]
[1] Jurusan Teknik Geologi, Sekolah Tinggi Teknologi Nasional, Yogyakarta,

* Corresponding author : hita@sttnas.ac.id
Received: Feb 12, 2019; Accepted: June 19, 2019.
DOI: 10.25299/jgeet.2019.4.2.2682

Abstract

The location of the discovery of mollusk fossils on the island of Java is spread in various places. One location is in the Kulon Progo region known as West Progo beds. However, due to the lack of studies of mollusk fossils in the Kulon Progo region, this resulted in a lack of understanding of the location of the discovery. This study was intended to re-record the location of fossil molluscs discovery in the Kulon Progo region, with the aim of contributing to the stratigraphic arrangement in Kulon Progo. Research methods include literature studies, field investigations and laboratory analysis. The literature study includes libraries of the Dutch colonial era regarding the location of the discovery of mollusk fossils. Field studies in the form of stratigraphic measurements and sampling. Laboratory investigations include petrographic observations and identification of micro and macro fossils. The results of the investigation successfully re-identified the Kembang Sokkoh and Spolong locations which are two types of locations on the West Progo beds. Based on the lithological characteristics of the two locations included in the Jonggrangan Formation, with the Lower Miocene age based on an analysis of the fossil content of the molluscs.
Keywords: Type locality, Mollusks, Jonggrangan, West Progo, Kembang Sokkoh, Spolong

1. Introduction

During the Dutch colonial period, geological investigations on Java were always helped by the discovery of fossil mollusks in various places. These discoveries spread almost in all physiographic zones on Java. One of the locations of the discovery was in the Kulon Progo area, which Martin (1919) referred to as West Progo beds. There are two important locations that represent the age of the Early Miocene, namely in Kembang Sokkoh and Spolong (van den Hoek Ostend, et al, 2002).

Research on the use of mollusk fossils in Indonesia is still little done, some of which have already done include Pandita and Zaim (2009), Pandita, et al (2013), Kase et al. (2008), and Kase, et al. (2015). This condition results in fossils of mollusks not being an important asset in the utilization in the field of geology. One of the important things in utilization is biostratigraphy.

Mollusk fossils have not been utilized in geological aspects, especially biostratigraphy, because there is still little information about various places containing fossil mollusks (Pandita, et al, 2013. Based on the old literature review, it is estimated that there are more than 20 locations of fossil mollusk discoveries on Java (Martin, 1919; van Es, 1931). These locations are spread in West Java, Central Java, Yogyakarta and East Java. In the Yogyakarta region these locations are located in Kembang Sokkah and Mount Spolong, which represent the West Progo level (Martin, 1919)

The stratigraphic position of each location needs to be reviewed again both in terms of biostratigraphy and lithography. One interesting location to study is the West Progo stage. The location needs to be identified again both from the stratigraphy and also the location coordinates, because there is no coordinate point listed when the location was examined (Martin, 1919). The lack of clarity about the location has an uncertain stratigraphic position.

2. The Objectives

This research is intended to re-identify the location of the type of mollusk fossil discovery that represents the West Progo stage. In addition, it is also intended to record fossils of mollusks and microfossils that can still be found. While the final goal is to find out the description of the stratigraphic position of the location

3. Methods

The research method carried out in the form of field investigations and laboratory investigations. Field investigations were carried out in the form of measuring stratigraphy, rock and fossil sampling. In laboratory activities it consists of observing thin rock section, identifying macro and micro fossils.

After conducting field and laboratory investigations various analyzes were carried out. The analysis carried out in the form of rock type analysis, age analysis and depositional environment. The last stage is a synthesis

of the stratigraphic position of the West Progo type location.

4. Regional Geology

4.1 Physiography

The physiographically of the study area are located in the Kulonprogo Mountains sub zone (van Bemmellen, 1949) (Figure 1). This sub zone is restricted to the western part with the South Serayu Mountain Zone while in the east it is bounded by the Yogyakarta plain. In the north it borders the central depression zone of Central Java, while in the south with the South Coast of Java (van Bemmellen, 1949).

The Kulonprogo Mountains Zone itself is a dome that extends north-south. Some researchers think the formation of this dome was controlled by tertiary volcanic activity (van Bemmellen, 1949). However, a number of other researchers such as Sopaheluwakan (1994) and Soeria Atmadja, et al. (1991) assume that the formation of this dome is related to the existence of twice the tectonic phase in this area.

4.2 Stratigraphy

The lithostratigraphy of Kulonprogo dome has been proposed by several researchers such as van Bemmellen (1949), Rahardjo, et al. (1995), Kadar (1985), Pringgoprawiro and Riyanto, (1988). Based on some of these researchers the stratigraphic sequences from the oldest to the young are as follows (Bemmelen, 1949; Kadar, 1985 and Rahardjo, 1995).

The oldest formation found in Kulonprogo is the Nanggulan Formation. This formation is estimated to have formed in the Middle Eocene based on fossil content of Nummulites and Discocyclina (van Bemmelen, 1949). The depositional environment is estimated to begin in the transition area transformed into a shallow sea.

Unconformity overly the Nanggulan Formation deposited by the Old Andesite Formation. The naming of this formation was proposed by Bemmelen (1949) for all volcanic rocks in Sumatra and Java that formed in Late Paleogene to the Early Miocene. A number of name revisions to this formation were submitted by many authors relating to naming that did not follow the rules of the Indonesian Stratigraphic Code. Purnamaningsih and Pringgoprawiro (1981) proposed two names namely the Kaligesing Formation for units characterized by sediments in the sea, and the Hamlet Formation for volcanic rocks formed on land. Rahardjo, et al. (1995) gave the name of the Kebobutak Formation because of the lithological characteristics that are similar to the rock units found in the Southern Mountains of East Java. This formation is composed of volcanic rocks in the form of andesite breccia with andesite lava. This formation is thought to be deposited in two different environments, namely the sea and land facies. This rock is thought to have formed in the Oligocene - Early Miocene. The thickness of this formation is estimated at 660 m (Rahardjo, et al., 1995). Overly the Old Andesite Formation is unconformity deposited by the Jonggrangan Formation. The lower part of the Jonggrangan Formation is composed by conglomerates which are overlain by tuffaceous marbles and side sandstones with lignite inserts. The upper direction of the Jonggrangan Formation transforms into layered limestone and coral limestone. This formation is expected to form in the Early Miocene and at the bottom of the Formation with the Sentolo Formation. The thickness of the Jonggrangan Formation is estimated at 250 m (Rahardjo et al. 1995).

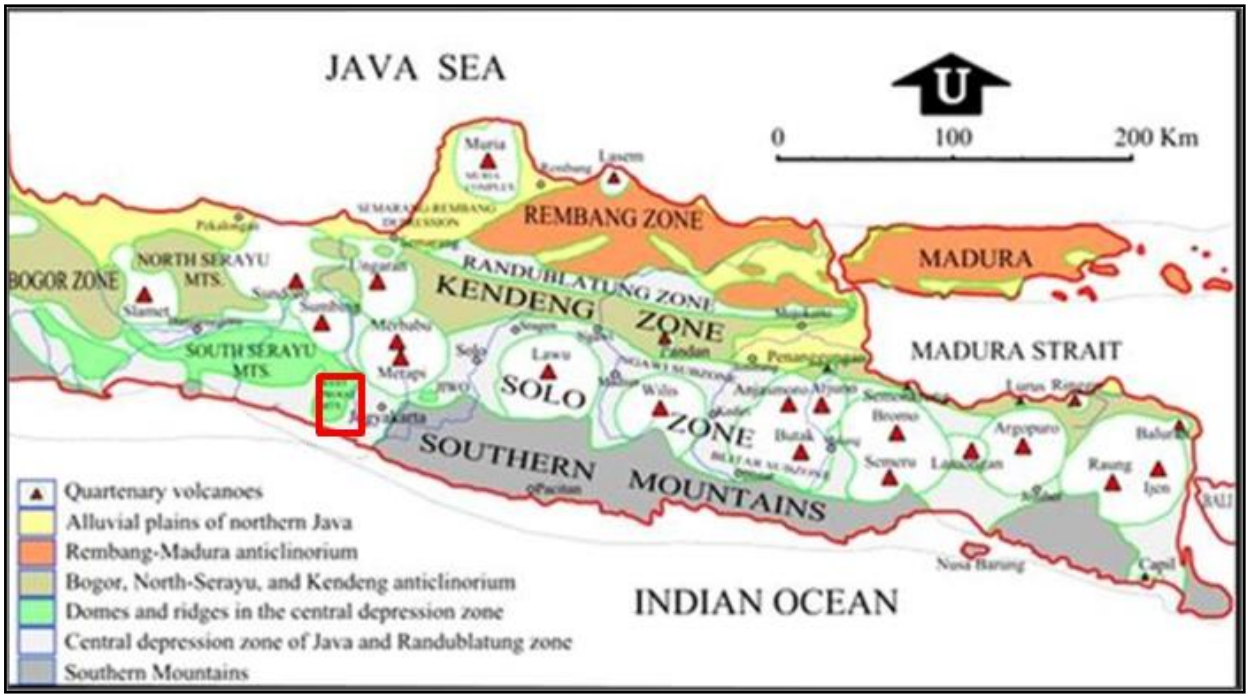

Figure 1. Physiography of Central and East Java (van Bemmelen, 1949), red box research location.

Interfingering with the Jonggrangan Formation is deposited by the Sentolo Formation. In the Giripurwo area, conformity contact found between the Sentolo Formation at the top and the Old Andesite Formation at the bottom. The lower part of the Sentolo Formation is a base conglomerate which is boarded by tufaceous marl with a thin layer vitric tuff. This rock upward gradually turns into layered limestone rich in Foraminifera. From the results of the planktonic foraminifera analysis several previous studies concluded that this formation was estimated to have formed during the Early Miocene to the Pliocene (N7 - N21). The thickness of this formation is estimated at 950 m (Rahardjo et al., 1995).

Unconformable overly the tertiary-aged rocks are quarter volcanic breccias. This volcanic breccia originates from Old Merapi Mountain and Young Merapi Mountain. The distribution of this unit is in the Yogyakarta basin which extends between the River Progo in the west to the Opak River in the east (Rahardjo, et al., 1995).

5. Data and Analysis

Field investigations were carried out at three locations namely KS01, KS02 and KS05 located on the eastern slope of Mount Kelir, Kulonprogo (Figure 2). Site selection is based on written information from Martin (1919) which describes the location of discovery of mollusk fossils from the West Progo level.

Table 1. Kulon Progo stratigraphic correlation from several researchers.

ERA	PERIODE		Bemmelen (1949)	Kadar (1985)	Rahardjo, et al. (1995)
Caenozoic	Quart.		Quarternary Volcanic	Quarternary Volcanic	Quarternary Volcanic
	Tertiary	Pliocene			
		Miocene	Sentolo Fm.	Sentolo Fm. Tj. Gunung Mb. Genung Mb. Karanganyar Mb.	Sentolo Fm.
			Jongrangan Fm	Jongrangan Fm	Jongrangan Fm
		Oligocene	Old Andecite Fm.	Old Andecite Fm.	Kebo-Butak Fm.
		Eocene	Gamping-Wungkal Fm.	Seputih Mb. Nanggulan Fm.	Nanggulan Fm.

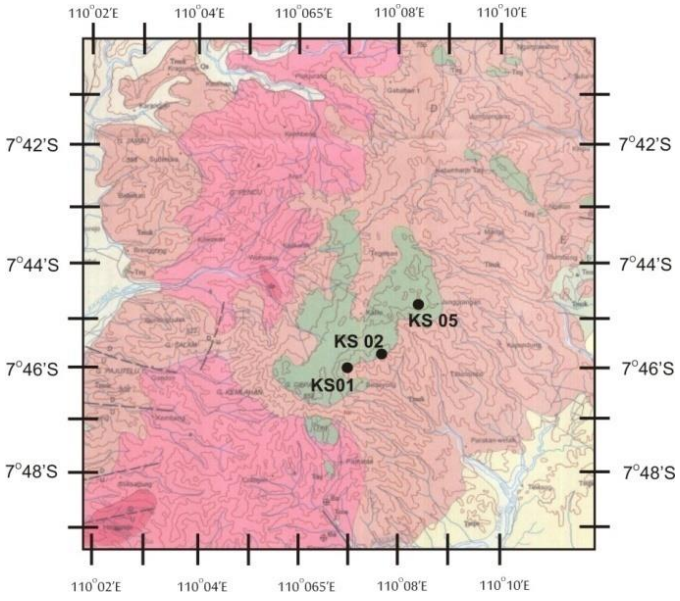

Figure 2. Research Location based on Yogyakarta Regional Geological Map from Rahardjo, et al. (1995), green is the Jonggrangan Formation, Brown Color of the Old Andesite Formation.

5.1 KS01 Location

The KS01 location is in the Kembang Soka area with geographic coordinates of 7O46 '5.47' LS and 110O6 '59.7' BT. Outcrops of ± 15 m thick show very strict lithological changes where the lower part of the igneous rock is brownish red, while on top of it is brownish sandstone (Figure 3).

The outcrop conditions at the bottom experience weathering which is controlled by oxidation. In handspecimen observation fresh gray color, porphyritic fanatic rock texture, with massive structure, mineral composition include pyroxene, plagioclase feldspar, k-feldspar, hematite, hornblende, quartz, with a period of basic alteration minerals, which are interpreted as altered basal porphyry. Frozen rocks have undergone purple alteration at the bottom.

At the top there are brownish white sandstones. The sandstone is resembled by fossils of Architectonica molluscs. Mollusk fossils cannot be taken because the location has become a tourist spot for the Soka Kembang waterfall.

Based on a literature review of the location of the type of mollusk fossil discovery in the Kulon Progo region (Martin, 1919), it is likely that this KS01 location is the location of the Sokkah Flower. This is in accordance with the description of the location of Martin (1919) which illustrates that one location type of the Lower Miocene level is on the slopes of Mount Kelir in the village of Kembang Sokkoh.

5.2 KS02 Location

The location of KS02 is north of Kembang Soka, located on the edge of the road that connects Jonggrangan village to the Sermo reservoir, located at coordinates 07O45'38.8 "LS, 110O07'41.5" BT (Figure 4). At this location stratigraphic measurements are carried out, with a thickness reaching almost 50 meters.

From the results of measured stratigraphic measurements can be found several lithological variations from young to old layers (Figure 5). At the bottom, calcarenite is found with lignite inserts and carbonate sandstones. A number of mollusk fossils can be found in this location such as Haustator subulata which becomes an index at the level of West Progo (Oostingh, 1938).

In the middle it changes to calcarenite with the insertion of a crystalline limestone. Mollusk fossils are still found with unfavorable and cracked preservation conditions. Lignite inserts are also found in this section.

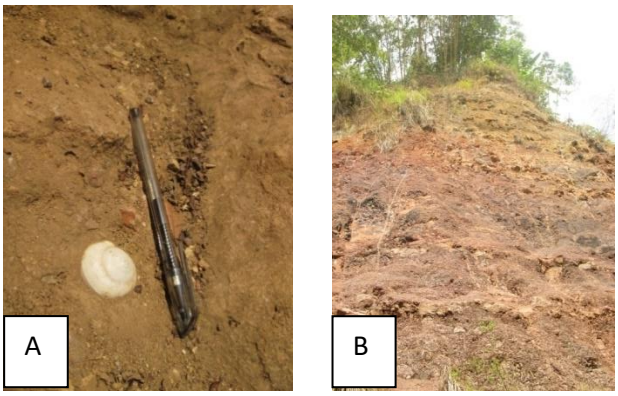

Figure 3. (A) Contact between andesite at the bottom with sandstones at KS01 location, Kembang Soka tourism site . (B) Fossil Architectonica found in sandstones.

Figure 4. Initial location of MS at KS02B.

5.3 KS05 Location

The KS05 location is to the east of Kiskenda Cave and to the west of Jonggrangan Village, known as Sibolong hill. Located on the edge of the road that connects Jonggrangan village with Kiskenda Cave, Located at coordinates 07O44'47.5 "LS, 110O08'26.4" BT (Figure 6). At this location stratigraphic measurements are carried out. Thickness reaches almost 25 meters. Based on microscopic analysis showed bioclastic limestones, which are composed of large foraminifera fossils, benthic small foraminifera and shell fragments of molluscs.

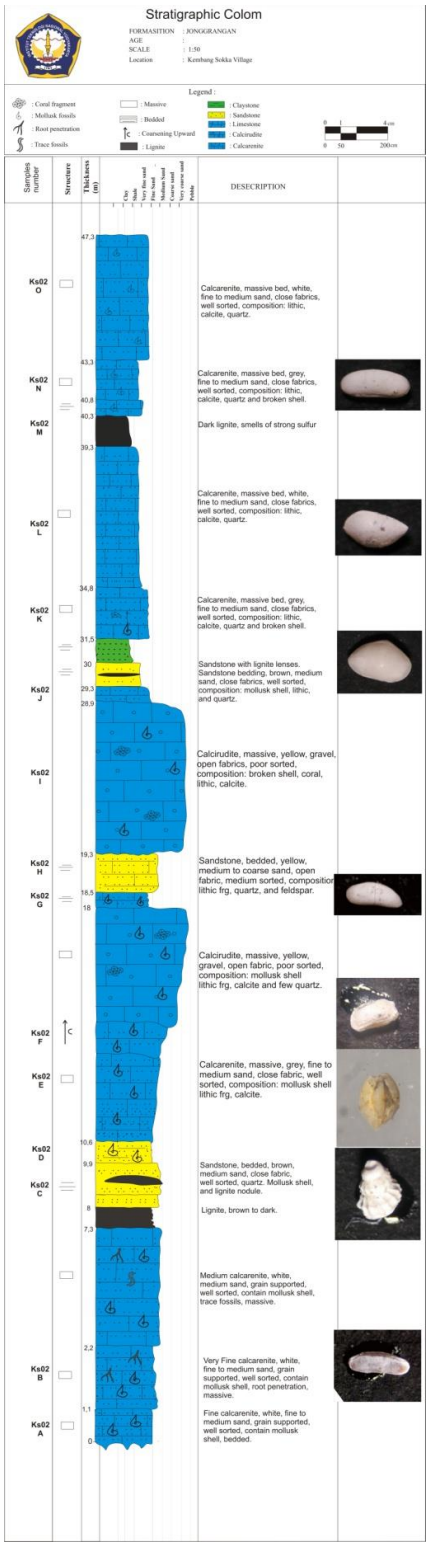

Figure 5. Measured stratigraphic section of KS02.

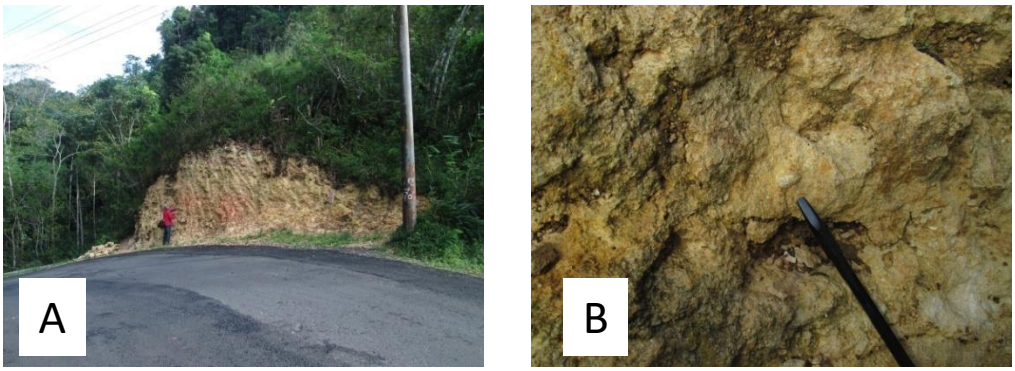

Figure 6. A) Location of KS05 in the Mount Sibolong area, B) the mollusk fossil found at the site.

The rock conditions generally have experienced a strong crystallinity process, so that the shells of mollusks cannot be separated from rocks. Currently this location is also a tourist spot in Mount Sibolong. This is an obstacle for the preparation of sampling mollusk fossils. Based on the description of the Sepolong location carried out by Martin (1919), it is likely that Mount Sibolong is a Spolong type location. Martin (1919) explained the location of the Spolong located west of Jonggrangan Village.

6. Paleontology Data

From the three observation locations, paleontological analysis has been carried out both macrofossil and microfossil. Some of the fossils identified are mollusks, ostracoda, foraminifera, and coral. The complete results of the fossils identified from the three locations can be seen in table 2. Specific sampling locations for KS05 were not possible due to the prohibition of taking rocks at that location.

7. Stratigraphic Analysis

Martin (1919) describes two locations representing the levels of West Progo beds, namely Sokkoh and Spolong Flowers. Kembang Sokkoh is described as being on the eastern slope of Mount Kelir located in the flow of the waterfall. Meanwhile the described Spatial area is to the west of Jonggrangan hamlet. Based on the second description of the location of Martin (1919) and the findings in the field, the KS01 and KS02 locations are most likely the Kembang Sokkoh location. Whereas the KS05 location which is to the west of Jonggrangan village is the location of Spolong, this is also from the resemblance of spolong and sibolong names.

Based on the fossil content found in the field, age analysis can be carried out from both types of locations. Based on the content of mollusk fossils of Haustator subulata and Conus spolongensis it is thought to have Early Miocene age (Martin, 1919). Some fossils of benthic foraminifera have a very long life span, such as Gyroidina soldanii (Oligocene to Recent), Elphidium sp (Miocene to Recent) and Quinqueloculina sp (Miocene to Recent). Fossils Ostracoda that appear also range in longevity such as Laxoconcha (Oligocene to Recent) and Dolerocypris sinensis (Miocene-Pleistocene). Based on these fossils, it is estimated that rocks exposed in Kembang Soka and Spolong have Early Miocene age.

8. Discussion

Referring to the purpose of the study to identify the location of the West Progo type, the location of the Kembang Soka and the Spolong hill are two locations that were once studied by Martin (1919). The West Progo type location is arranged by Martin (1919), lithostratigraphy is part of the Jonggrangan Formation. The name Jonggrangan Formation itself was first introduced by van Bemmellen (1949) and placed its age in the Early Miocene.

Table 2. Fossils found at the location of the Kembang Soka

No. Sample	Mollusk	Ostracoda	Foraminifera
KS01	*Architetonica*	*NA*	*NA*
KS02	*Haustator subulata*	*Loxoconcha*	*Nonion Incisum* Cushman
	Conus spolongensis	*Dolerocypris sinensis*	*Elphidium* sp
	Melanoides sp	*Bythocypris*	*Ozawaia tongaensis*
			Pyrgo bradyi
			Quinquelaculina sp
			Gyraidina soldanii
			Cibicides sp
			Nodosoria sp

The results of this study indicate that the age of the two locations, Kembang Soka and Sibolong showed an estimate in the Early Miocene. This condition is the same as that proposed by Martin (1919) and also van Bemmelen (1949). However, the determination of the age of the two outcrop locations still needs to be strengthened by another age analysis. This is because the paleontological data used for analysis still has a long range, namely Miocene to Resen. Two methods that need to be used are radiometric dating and Nannoplankton.

9. Conclusion

Overall data from the results of the study succeeded in re-identifying the location of the type of mollusk fossil discovery from the West Progo level compiled by Martin (1919). Both locations are located in Kembang Soka and Spolong Hill. There is an addition of paleontological data in the form of ostracoda, although it needs to be examined in more detail. The stratigraphic position can also be determined namely in the Early Miocene with its lithography as part of the Jonggrangan Formation.

Acknowledgement

Paper is part of the research on Competency Based Research in the form of Basic Research funded by DIPA Kopertis Wilayah V with a decree number 3 / E / KPT / 2018. Thank you to the Ministry of Research and Higher Education for funding. Not to mention also to the STTNas P3M who had facilitated this research in reporting and drafting proposals.

References

Kadar D, 1986, Neogene planktonic foraminiferal biostratigraphy Of The South Central Java Area Indonesia, Geological Recearch and Development Centre, Bandung.

Kase, T., Kitao, F., Aguilar, Y.M., Kurihara, Y., Pandita, H., 2008, Recontruction of Color Markings in Vicarya, a Miocene Potamidid Gastropod (Mollusca) from SE Asia And Japan, Paleontological Research, vol. 12, no. 4, pp. 345 - 353, Paleontological Society of Japan.

Kase, T., Kurihara, Y., Aguilar, Y.M., Pandita, H., Fernando A.G.S., and Hayashi, H., 2015, A New Cerithioidean Genus Megistocerithium (Gastropoda; Mollusca) from the Miocene of Southeast Asia: A Possible Relict of Mesozoic "Eustomatidae", Paleontological Research, 19(4):299-311. The Palaeontological Society of Japan, http://dx.doi.org/10.2517/2015PR013

Martin, K., 1919, Unsere Palaeozoologische Kenntnis von Java, mit einleintenden Bemerkungen uber die Geologie der Insel, 158 pp., 4 pls. E. J. Brill, Leiden

Oostingh, C. H., 1938, Mollusken als Gidsfossielen voor Het Neogeen in Nederlandsch-Indie, Handelingen van het achste Nederlandsch-Indisch Natuurwetenschap-pelijk Congres gehouden te, Soerabaja van 20-23 Juli 1938, pp. 508-516.

Pandita, H., dan Zaim, Y., 2009, Paleoekologi Formasi Pucangan di Daerah Kabuh ditinjau dari Kandungan Fosil Moluska, Prosiding Seminar Nasional RETII ke 4, Sekolah Tinggi Teknologi Nasional Yogyakarta.

Pandita, H., Zaim, Y., Aswan, dan Rizal Y., 2013, Relationship of Biometrical Aspect of Turritellidae with Geochronological Aspect in West Java, International Journal of Geoscience, Vol. 4, No. 4, Scientific Research Publishing.

Pringgoprawiro,H. dan Riyanto, B. (1988), Formasi Andesit Tua suatu Revisi, Bandung Inst.Technologi, Dept.Geol.Contr., 1-29.

Purnamaningsih, S. dan Pringgoprawiro, H. (1981), Stratigraphy and planktonic foraminifera of the Eocene-Oligocene Nanggulan Formation, Central Java, Geol.Res.Dev.Centre Pal.Ser. Bandung,Indonesia, No. 1, 9-28.

Rahardjo, W., Sukandarrumidi, dan Rosidi, H.M.D., 1995, Peta Geologi Lembar Yogyakarta, Jawa, Pusat Penelitian dan Pengembangan Geologi, Bandung.

Soeria-Atmadja, R., Maury, R. C., Bellon, H., Pringgoprawiro, H., Polves, M., and Priadi, B; Tertiary magmatic belts in Java, Journal of Southeast Asian Earth Science, 9, pp. 13-27 (1994).

Sopaheluwakan J. (1994), Critiques and a new perspecrive on basement tectonic studies in Indonesia : a review of current results and their significance in geological exploration, Prosiding tridasawarsa Puslitbang Geoteknologi LIPI, II, 163-175.

Van Bemmellen, R.W., 1949, The Geology of Indonesia. The Hague, Martinus Nijhoff, vol. IA.

van den Hoek Ostende, L. W., Leloux, F. P. J., Wesselingh, F& Winkler Prins, C. F., 2002, Cenozoic Molluscan types from Java (Indonesia) in the Martin Collection (Division of Cenozoic Mollusca), National Museum of Natural History, Leiden

Van Es, L.J.C., 1931, The Age of Phitecanthropus, The Hague Martinus Nijhoff, pp 122.